

Requirements for Receiving Genomic Evaluations in Canada

Canadian Dairy Network (CDN) has published official genomic evaluations since August 2009 and this service also includes the release of monthly genomic updates for newly genotyped females. Until recently, all genomic evaluations were based on genotypes derived using the 50K panel under a North American collaborative agreement where all genotypes between Canada and the United States are shared. In September 2010, Holstein Canada and the Semex Alliance partners jointly launched the GenoTest Program designed to encourage the genotyping of heifers and cows, especially with the new 3K panel on a broad basis. DNA collection may now be conducted using tail hair or a nasal swab kit that must be ordered in advance from Holstein Canada. GenoTest also offers producers continued accessibility to genotyping with the 50K panel. This higher density panel maximizes the increase in accuracy that is obtainable and ensures that information for elite and/or highly merchandized females will be available on both sides of the border. The first genomic evaluations for animals genotyped with the 3K panel were released by CDN on October 12, 2010. The introduction of options for both sampling methods (tail hair or nasal swab) and panel types (3K or 50K) has required CDN to modify policies for the publication of genomic evaluations in Canada as outlined below.

What Genotypes are Used for Genetic Evaluations?

The first basic criterion for genomic testing in Canada is that the animal must be registered in the appropriate breed association herdbook and the submitter must be an owner of the animal or an authorized representative. The requirement for herdbook registration is imposed since only animals with a known sire are eligible and useful for traditional genetic evaluations. An application for registration of Holstein animals to be genotyped as newborn calves or at a very young age may be submitted simultaneously with the animal's DNA sample (tail hair or nasal swab) to Holstein Canada to allow for a timely turnaround in providing the genomic evaluation. The individual animal query pages from either the CDN or Holstein Canada web sites offer producers the ability to print a GenoTest Application Form that is pre-filled with the animal's registration number (and associated bar code for scanning), name and herd management ID. Producers can then print and complete the remainder of the form and include it with the submission of the animal's tail hair or nasal swab kit to Holstein Canada.

Once the DNA samples are received at Holstein Canada, an initial visual inspection is conducted in order to minimize potential problems likely to result in an unsuccessful laboratory analysis. Samples that are processed at the laboratory may still not be successfully genotyped due to poor DNA quality and/or insufficient quantity. For either of the above situations, producers are not invoiced for genotyping services but are contacted and asked to resubmit a new DNA sample for that animal. Genotypes that successfully pass the laboratory quality control process are then checked for parentage inconsistencies against the pedigree information provided as well as a general validation

of the resulting genotype quality for use in genetic evaluations. Any parentage conflicts that arise must be resolved before the genotype can be used to compute the animal's genomic evaluation but in either of these scenarios, the producer remains responsible for covering the genotyping fees to Holstein Canada.

Given the recent launch of 3K genotyping services offered by a variety of organizations in North America, the CDN Board of Directors recently established a list of authorized submitters of 3K genotypes for females for inclusion in Canadian genetic evaluations. This list currently includes all CDN member organizations but also allows the US-based breed associations to provide genotyping services for females in the United States. GenoTest is currently the only national genotyping service in Canada that guarantees a Canadian-based genomic evaluation for all females with either a 3K or 50K genotype that passes the various quality control measures.

Imputation of 3K Genotypes

The genomic evaluation system at CDN was built to use information from 50K genotypes along with pedigree data and traditional genetic evaluations. These informative genotypes for over 9,000 progeny proven sires are the foundation to the procedure used to estimate genomic evaluations for younger males as well as all heifers and cows. In addition, since nearly 50,000 animals in North America have already been genotyped with the 50K panel, methods have been developed to “transform” the 3K genotypes into 50K genotypes using “imputation”. The accuracy of this imputation procedure varies depending on which ancestors, especially sire, dam and maternal grandsire, have been genotyped and which testing panel was used in each case. On average, however, the gain in Reliability of genomic evaluations resulting from 3K genotypes has roughly been equal to 90% of the Reliability gain that would otherwise have been realised with a 50K genotype. During these early stages of including 3K genotypes in official Canadian genetic evaluations, the Genetic Evaluation Board of CDN determined that the Top GLPI list for cows and the Top GPA LPI list for heifers would only include females genotyped with the 50K panel or those genotyped with the 3K panel as long as both its sire and dam were genotyped with the 50K panel. This policy will be reviewed over time, as more research becomes available regarding the accuracy of imputation.

Publication of Genomic Evaluations in Canada

All males and females in North America that are genotyped with the 50K panel will continue to receive official genomic evaluations in both Canada and the United States. This is an important benefit associated with paying for the higher cost 50K genotyping service. A.I. companies authorized to genotype young candidate bulls in North America may use the 3K panel for screening purposes, however all bulls entering A.I. must be (re)genotyped using the 50K panel in order to receive an official genomic evaluation in Canada. Any such official genomic evaluations shall be published only after the A.I. organization has identified the purchased young bull and that bull has reached at least nine months of age. The CDN Board of Directors approved these policies to ensure the long-term sustainability of an accurate genomic evaluation system in Canada and to provide the maximum Reliability possible of genomic evaluations for A.I. bulls offered to Canadian producers.

All females genotyped using the 3K panel submitted through the GenoTest Program with qualify for a Canadian-based genomic evaluation. Females genotyped outside of Canada (i.e.: in the United States) will receive official genomic evaluations in Canada only if (a) the DNA was submitted by a CDN member organization, (b) the female is an ancestor of any genotyped male or (c) the female exists within the Holstein Canada and/or CDN database. These criteria essentially exclude any heifer or cow in the United States genotyped with the 3K panel when she is not in some way linked to a Canadian animal or to a young sire of potential A.I. interest.

Summary

Canadian dairy producers now have easy access to affordable genotyping services using either the 3K panel or the 50K panel with options for DNA collection being tail hair or nasal swab kits. As with any data collection system, there are minimum requirements established for the use of such data in genetic evaluations. In the case of genomics, this requires a good quality DNA sample from animals registered in the breed association herdbook and no parentage conflicts before an animal's genotype is usable. In addition, to protect the interests of the Canadian dairy producer and the industry at large, CDN has approved a list of authorized submitters of 3K genotypes for heifers and cows and has implemented minimum standards for the publication of genomic evaluations for A.I. sires and elite females in Canada.

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